ULTIMHEAT® MUSEUM

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Technology of components used in heating.

Chapter 36

Absolute pressure, barometric pressure, negative pressure, differential pressure

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Absolute pressure, barometric pressure, negative pressure, differential pressure, basic definitions

1 / Definitions
Although the pressure is an absolute value, the current pressure values are generally made with respect to the ambient air pressure: This is the relative or barometric pressure.
According to the definition of pressure, it should be given in relation to the vacuum: It is the absolute pressure.
The pressure can also be given with respect to another measurement of pressure, different from the atmospheric pressure: It is the differential pressure.

- The absolute pressure is the one that takes as zero point the zero pressure of the vacuum. There is no negative pressure with respect to the zero point of the vacuum zero pressure

- The differential pressure:
This is the pressure difference between two points. Differential pressures are commonly used in industrial systems and processes. The pressure switches and differential pressure gauges have two input ports, each connected to one of the volumes whose pressure is to be monitored.

- The barometric pressure, variant of the differential pressure, also called relative pressure:
It is the one that takes atmospheric pressure as zero point. The absolute pressure value of atmospheric pressure is generally about 100 kPa at sea level, but it varies with altitude and weather conditions.
In the measurements with respect to the barometric pressure, two possible cases are distinguished:

- The negative pressure, which is the pressure below the atmospheric pressure. It is expressed in pressure difference relative to the atmospheric or barometric pressure and is preceded by the minus sign.
The reference zero is the value of the atmospheric pressure, and is often implied by the context, and is added only when clarification is needed. For example: Tire pressure and blood pressure are relative pressures by convention, while atmospheric pressure, deep vacuum pressure, and altimeter pressure are absolute pressures.
The indication of the moderate depressions is often ambiguous, because when the minus sign is not written, it can represent either an absolute pressure thus positive compared to the vacuum, or a negative barometric pressure.
Thus, if the minus sign is forgotten, a vacuum of 25 kPa can be understood as being an absolute pressure of 25 kPa (about 75 kPa below atmospheric pressure) or 25 kPa below atmospheric pressure.

2 / Units of measurement

2-1 Legal unit of pressure measurement
Since 1971, the SI pressure unit (international system) is Pascal (Pa), equal to one Newton per square meter (N / m²) Before that, the pressure in the SI was expressed in N/m².
In order to avoid confusion between absolute pressure and barometric pressure, the words "abs. "(For: absolute) is to be put in parentheses after the indicated value. Example 101 kPa (abs).

2-2 Traditional units and ratings still in use
- PSI, which is still widely used in the United States and Canada. A suffix is often placed behind PSI to indicate the zero reference: PSIA for absolute, PSIG for barometric pressure, PSID for differential pressure.
-Because pressure was once commonly measured by its ability to move a column of liquid in a graduated glass tube, pressures are also often expressed as a length in mm or inches of a particular fluid such as mercury (Hg) or water. Although obsolete, these units are still used in many areas:

- In the medical community, blood pressure is measured in millimeters of mercury in most parts of the world, and respiratory pressures are expressed in centimeters of water column and are still common.
- The pressures of natural gas pipelines are measured in inches of water, expressed as "WC" ("Water Column").
- In vacuum systems, Torr, and mm of mercury (mmHg) and inches of mercury (inHg) are the most commonly used. Torr and millimeters of mercury generally indicate absolute pressure, while inches of mercury generally indicate relative pressure
- Atmospheric pressures are usually expressed in kPa (kilopascal), or atmospheres (atm), except for meteorology where hectopascal (hPa) and millibar (mbar) are preferred

2-3 Other old units of pressure generally abandoned:
- Barye (BA), was defined as equal to 1 dyne/cm², in the old CGS system
- The technical atmosphere (symbol: at) was defined as the pressure exerted by a water column of 10 meters: 1 technical atmosphere is therefore exactly equivalent to 98066.5 Pa.
- The normal atmosphere (symbol: atm) was defined in 1954 as being equal to 1,013,250 dynes per square centimeter (101,325 Pa). It corresponds to the pressure of a height of 760 mm of mercury at 0°C, under the normal acceleration of gravity (9.80665 m/s²). It represents the average atmospheric pressure at mean sea level on the latitude of Paris. It was used in technical documents during the period 1960-1980.
- The Torr, which had been defined as being 1/760 of a normal atmosphere. The value of the Torr was therefore equal to a column of 1mm of mercury

2-4 Other Hybrid Pressure Measurement Units:
- The millimeter of mercury per cm² (mm Hg/cm ²)
- The gram-force per cm² (gf/cm²)
- The kilogram-force per cm² (kgf/cm²)
For the record, the use of kilogram, gram, kilogram force, or gram force (or their symbols) as a unit of force is forbidden in the current SI system, since the unit of force is Newton (N).